CERTIFICATION EXAMINATIONS

IN

CLINICAL NEPRHOLOGY TECHNOLOGY

AND

BIOMEDICAL NEPHROLOGY TECHNOLOGY

Handbook for Candidates

National Nephrology Certification Organization

PROFESSIONAL TESTING CORPORATION® 1350 BROADWAY • 17th FLOOR • NEW YORK, NY 10018

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This handbook contains necessary information about the Clinical Nephrology Technology and Biomedical Nephrology Technology certification examinations. Please retain it for future reference. Candidates are responsible for reading these instructions carefully. This handbook is subject to change.

CERTIFICATION

The National Nephrology Certification Organization (NNCO) endorses the concept of voluntary, periodic certification by examination for all individuals in the field of nephrology technology. Certification is one part of a process called credentialing. It focuses specifically on the individual and is an indication of current competence in a specialized area of practice. Certification in nephrology technology is highly valued and provides formal recognition in the profession of nephrology technology. **In addition, NNCO certification meets the requirements mandated by the Centers for Medicare & Medicaid Services (CMS) that patient care technicians be certified.**

PURPOSES OF CERTIFICATION

TO PROMOTE DELIVERY OF SAFE AND EFFECTIVE CARE IN NEPHROLOGY TECHNOLOGY PRACTICE THROUGH THE CERTIFICATION OF QUALIFIED CLINICAL AND BIOMEDICAL NEPHROLOGY TECHNOLOGY BY:

1. Recognizing formally those individuals who meet the eligibility requirements of the National Nephrology Certification Organization and pass the Certification Examination in Clinical Nephrology Technology or Biomedical Nephrology Technology.
2. Encouraging continued personal and professional growth in the practice of nephrology technology.
3. Establishing and measuring the level of knowledge required for the delivery of quality patient care.
4. Providing a standard of knowledge requisite for certification; thereby assisting the employer, state agencies, public, and members of the health professions in the assessment of nephrology technology.

ELIGIBILITY REQUIREMENTS

1. Have a minimum of a high school diploma or the equivalent OR four years of full time experience in the field of nephrology technology
2. Completion of a one-year nephrology technology training program* with clinical experience and/or completion of a combination nephrology technology training program of less than 1 year and work experience equivalent to 1 year
3. Completion and filing of an Application for the Certification Examinations in Nephrology Technology
4. Payment of required fee

*** Clinical Nephrology Technician candidates in Ohio please note**: A minimum of 12 months experience in dialysis care is required in order to take the examination. Dialysis care is defined as: performing and monitoring dialysis procedures, including initiating, monitoring, and discontinuing dialysis; drawing blood; administering medications when the administration is essential to the dialysis process; and responding to complications that arise during dialysis.

ADMINISTRATION

The Certification Program is sponsored by the National Nephrology Certification Organization. The Certification Examinations in Clinical Nephrology Technology and Biomedical Nephrology Technology are administered for the NNCO by the Professional Testing Corporation (PTC), 1350 Broadway - 17th Floor, New York, New York 10018, (212) 356-0660, www.ptcny.com. Questions concerning the examinations should be referred to PTC.

ATTAINMENT OF CERTIFICATION AND RECERTIFICATION

Eligible candidates who pass the Certification Examination in Clinical Nephrology Technology are eligible to use the registered designation CCNT after their names and will receive certificates from the NNCO. Eligible candidates who pass the Certification Examination in Biomedical Nephrology Technology are eligible to use the registered designation CBNT after their names and will receive certificates from the NNCO. A registry of CCNTs and CBNTs will be maintained by the NNCO and may be reported in its publications.

Certification in Nephrology Technology is recognized for a period of four years at which time the candidate must retake and pass the current Certification Examination in Clinical Nephrology Technology or Biomedical Nephrology Technology or meet such alternative requirements as are in effect at that time in order to retain certification. Go to http://www.ptcny.com/clients/NNCO for further information.

REVOCATION OF CERTIFICATION

Certification will be revoked for any of the following reasons:

1. Falsification of an Application.
2. Falsification of any material requested by the NNCO.
3. Misrepresentation of certification status.

The appeals process of the NNCO provides the mechanism for challenging revocation of Certification. It is the responsibility of the individual to initiate this process.

COMPLETION OF APPLICATION

PART I:
Complete or fill in as appropriate ALL information requested on the Application. Mark only one response unless otherwise indicated.

NOTE: The name you enter on your Application must match exactly the name listed on your government issued photo ID such as driver's license or passport. Do not use nicknames or abbreviations.

CANDIDATE INFORMATION: Starting at the top of the Application, print your name, address, phone number, and e-mail address in the appropriate row of empty boxes.

ELIGIBILITY AND BACKGROUND INFORMATION: All questions must be answered. Mark only one response unless otherwise indicated.

OPTIONAL INFORMATION: These questions are optional. The information requested is to assist in complying with equal opportunity guidelines and will be used only in statistical summaries. Such information will in no way affect your test results.

CANDIDATE SIGNATURE: When you have completed all required information, sign and date the Application in the space provided.

PART II:
Complete all information requested. Be sure to print your name on the line provided as you wish it to appear on your certificate, and to indicate the examination for which you are registering. Read the statement following CANDIDATE AFFIRMATION, sign on the line indicated for your signature, and enter the date.

Mail the Application with the appropriate fee (see FEES on page 5) and all required documentation to:

NNCO EXAMINATIONS
PROFESSIONAL TESTING CORPORATION
1350 Broadway - 17th Floor
New York, New York 10018

NOTE: Submit Application at least one month prior to your preferred testing date.

EXAMINATION ADMINISTRATION

The Certification Examinations in Clinical Nephrology Technology and Biomedical Nephrology Technology are administered on an ongoing basis, Monday through Saturday, excluding holidays, at computer-based testing facilities managed by PSI. PSI has several hundred testing sites in the United States, as well as Canada. Scheduling is done on a first-come, first-serve basis. To find a testing center near you visit: www.ptcny.com/cbt/sites.htm or call PSI at (800) 733-9267. Please note: hours and days of availability vary at different centers. You will not be able to schedule your examination appointment until you have received a Scheduling Authorization from PTC.

ONLINE SOFTWARE TUTORIAL

A Testing Software Tutorial can be viewed online. Go to http://www.ptcny.com/cbt/demo.htm. This online Testing Software can give you an idea about the features of the testing software.

SCHEDULING YOUR EXAMINATION APPOINTMENT

Scheduling Authorizations will be emailed to candidates approximately 10 days after the application has been received, reviewed, and processed. The Scheduling Authorization will indicate how to schedule your examination appointment as well as the dates during which testing is available. Appointment times are first-come, first-serve, so schedule your appointment as soon as you receive your Scheduling Authorization in order to maximize your chance of testing at your preferred location and on your preferred date. If you do not receive a Scheduling Authorization within two weeks of submitting your application, contact the Professional Testing

Corporation at (212) 356-0660. Scheduling Authorization emails sometimes end up in junk/spam mail folders. Please add notices@ptcny.com to your contacts or list of safe email addresses.

Your current government-issued photo identification, such as a driver's license or passport, must be presented in order to gain admission to the testing center. PTC also recommends you bring a paper copy of your Scheduling Authorization and your PSI appointment confirmation with you to the testing center.

After you make your test appointment, PSI will send you a confirmation email with the date, time and location of your exam. Please check this confirmation carefully for the correct date, time and location. Contact PSI at (800) 733-9267 if you do not receive this email confirmation or if there is a mistake with your appointment.

Candidates have six (6) months from the date of application to sit for the examination. After the six-month period, candidates will need to reapply for the examination and pay a new application fee.

- **It is your responsibility as the candidate to call PSI to schedule the examination appointment.**
- **It is highly recommended that you become familiar with the testing site prior to your appointment.**
- **Arrival at the testing site at the appointed time is the responsibility of the candidate. Please plan for weather, traffic, parking, and any security requirements that are specific to the testing location. Late arrival may prevent you from testing**.

SPECIAL NEEDS

The NNCO and PTC support the intent of and comply with the Americans with Disabilities Act (ADA). PTC will take steps reasonably necessary to make certification accessible to persons with disabilities covered under the ADA. Special testing arrangements may be made upon receipt of the Application, examination fee, and a completed and signed Request for Special Needs Accommodations Form, available from www.ptcny.com or by calling PTC at (212) 356-0660. This Form must be uploaded with the online application at least EIGHT weeks before the testing period begins. Please use this Form if you need to bring a service dog, medicine, food or beverages needed for a medical condition with you to the testing center.

Information supplied on the Request for Special Accommodations Form will only be used to determine the need for special accommodations and will be kept confidential.

CHANGING YOUR EXAMINATION APPOINTMENT

If you need to cancel your examination appointment or reschedule to a different date, you must contact PSI at (800) 733-9267 no later than noon, Eastern Standard Time, of the second business day PRIOR to your scheduled appointment.

If you fail to arrive for your appointment or cancel without giving the required notice, you will forfeit your testing fee. Candidates have six (6) months from the date of application to sit for the examination. After the six-month period, candidates will need to reapply for the examination and pay a new application fee.

RULES FOR THE EXAMINATION

1. All electronic devices that can be used to record, transmit, receive, or play back audio, photographic, text, or video content, including but not limited to cell phones, laptop computers, tablets, Bluetooth devices; all wearable technology such as smart watches; MP3 players such as iPods; pagers, cameras, and voice recorders are not permitted to be used and cannot be taken into the examination room.

2. No papers, books, or reference materials may be taken into or out of the examination room.

3. Simple, nonprogrammable calculators are permitted with the exception of calculators as part of cellular phones, etc. A calculator is also available on screen if needed.

4. No questions concerning content of the examination may be asked during the testing session. The candidate should read carefully the directions that are provided on screen at the beginning of the examination session.

5. Candidates are prohibited from leaving the testing room while their examination is in session, with the sole exception of going to the restroom.

FEES

Application fee for the Certification Examinations in Nephrology Technology
(includes $50 computerized testing fee) $255.00

Fees must be submitted in U.S. dollars.

MAKE CHECK OR MONEY ORDER PAYABLE TO: **PROFESSIONAL TESTING CORPORATION**

Visa, MasterCard, and American Express are also accepted. Please complete and sign the credit card payment form on the Application.

REFUNDS

There will be no refund of fees. Candidates have six (6) months from the date of application to sit for the examination. After the six-month period, candidates will need to reapply for the examination and pay a new application fee.

REPORT OF RESULTS

At the end of the examination, candidates will receive a printout that confirms their completion of the examination. Candidates will receive an unofficial test results report prior to leaving the testing center. Candidates are not eligible to use the CCNT or CBNT credential until their official score is received. Candidates will be notified in writing by PTC within one week after test data is received by PSI whether they have officially passed or failed the examination. Scores on the major areas of the examination and on the total examination will also be reported. Successful candidates will also receive certificates from the NNCO.

REEXAMINATION

The Certification Examinations in Clinical Nephrology Technology and Biomedical Nephrology Technology may be taken as often as desired upon filing of a new Application and fee. There is no limit to the number of times an examination may be repeated.

CONFIDENTIALITY

1. The NNCO will release the individual test scores ONLY to the individual candidate.

2. Any questions concerning test results should be referred to NNCO or the Professional Testing Corporation.

STUDY GUIDE

An exam review course is available through the NNCO website. Visit www.nnco-cert.org.

ONLINE PRACTICE TEST IN CLINICAL NEPHROLOGY TECHNOLOGY (NNCO CCNT) AND ONLINE PRACTICE TEST IN BIOMEDICAL NEPHROLOGY TECHNOLOGY (NNCO CBNT)

WHAT IT IS: A practice test to provide candidates with a better understanding of what the actual certification examination is like. Each practice test consists of 50 questions, has a testing time of two hours, and is taken over the internet.

WHEN: Available at any time, according to the candidate's schedule.

WHY TAKE IT: To experience taking a computerized exam, to review an example of the type of content included in the Certification Examination, and to learn more about question format, style, and level of difficulty.

SCORE REPORT: After completing the online practice test, you will receive an instant score report showing test performance in each of the content areas. The score report does not provide correct answers or indicate which questions were answered correctly or incorrectly. Once the practice test is scored, you cannot return to the test to review the questions.

NOTE: Performance on the online practice test may differ from actual performance on the Certification Examination. Thus, there is no guarantee that taking this practice test will help you pass the Certification Examination. Candidates may, however, find it helpful to review content area in any areas of weakness indicated on the score report prior to taking the Certification Examination.

CONTENT INCLUDED IN THE ONLINE PRACTICE TEST IN CLINICAL NEPHROLOGY TECHNOLOGY

I. Principles of Dialysis
II. Care of the Patient with Kidney Failure
III. Dialysis Procedures and Documentation
IV. Complications of Dialysis
V. Water Treatment and Dialysate Preparation
VI. Infection Control and Safety
VII. Dialyzer Reprocessing

CONTENT INCLUDED IN THE ONLINE PRACTICE TEST IN BIOMEDICAL NEPHROLOGY TECHNOLOGY

I. Principles of Dialysis
II. Scientific Concepts
III. Electronic Applications
IV. Water Treatment
V. Equipment Functions
VI. Environmental/Regulatory Issues
VII. Dialyzer Reuse/Reprocessing

FEE: $60, payable by credit card online.

APPLY: Go to www.ptcny.com, scroll down to the section on Online Practice Tests, and select either the Online Practice Test in Clinical Nephrology Technology or the Online Practice Test in Biomedical Nephrology Technology, depending upon which Certification Examination you are preparing to take.

FURTHER INFO: Visit http://www.ptcny.com or call Professional Testing Corporation at 212-356-0660.

CONTENT OF EXAMINATIONS

1. The Certification Examinations in Clinical Nephrology Technology and Biomedical Nephrology Technology are computer-based examinations composed of a maximum of 200 multiple choice, objective questions with a total testing time of three (3) hours each.

2. The content for the examinations is described in the Content Outlines starting on page 9.

3. The questions for the examinations are obtained from individuals with expertise in nephrology technology and are reviewed for construction, accuracy, and appropriateness by the NNCO.

4. The NNCO, with the advice and assistance of the Professional Testing Corporation, prepares the examinations.

CONTENT OUTLINE FOR CLINICAL NEPHROLOGY TECHNOLOGY

THE CERTIFICATION EXAMINATION IN CLINICAL NEPHROLOGY TECHNOLOGY WILL BE WEIGHTED IN APPROXIMATELY THE FOLLOWING MANNER:

I.	Principles of Dialysis	10%
II.	Care of the Patient with Kidney Failure	18%
III.	Dialysis Procedures and Documentation	17%
IV.	Complications During Dialysis	15%
V.	Water Treatment & Dialysate Preparation	15%
VI.	Infection Control and Safety	20%
VII.	Dialyzer Reprocessing	5%

I. PRINCIPLES OF DIALYSIS

- A. CURRENT DIALYSIS ENVIRONMENT
- B. HISTORY OF DIALYSIS
  - 1. Technology Highlights
  - 2. Medicare Reimbursement for ESRD Patients
- C. DIALYSIS TECHNICIAN PROFESSIONALISM
- D. SCIENTIFIC TERMS USED IN DIALYSIS
  - 1. Solutions
  - 2. Semipermeable Membrane
  - 3. Diffusion
    - a. Solution
    - b. Membrane
  - 4. Osmosis
  - 5. Filtration and Ultrafiltration
  - 6. Fluid Dynamics
- E. APPLYING SCIENTIFIC PRINCIPLES TO DIALYSIS
  - 1. Fluid Dynamics in Dialysis
  - 2. Diffusion in Dialysis
  - 3. Ultrafiltration in Dialysis
  - 4. Osmosis in Dialysis
- F. APPLYING DIALYSIS PRINCIPLES TO THE DIALYSIS PRESCRIPTION
  - 1. Dialyzer
  - 2. Blood Flow Rate
  - 3. Dialysate Flow Rate
  - 4. Dialysis Time
  - 5. Dialysate Composition
  - 6. Anticoagulation
- G. DIALYSIS AND THE NORMAL KIDNEY COMPARISON

H. DIALYZERS
- 1. Functions and Components
- 2. Membranes
- 3. Dialyzer Characteristics
  - a. Biocompatibility
  - b. Surface Area
  - c. Molecular Weight Cutoff
  - d. Ultrafiltration Coefficients
- 4. Dialyzer Categories
  - a. Conventional
  - b. High-efficiency
  - c. High-flux
- 5. Dialyzer Design

I. MEASURING DIALYZER EFFECTIVENESS
- 1. Dialyzer Clearance
- 2. Ultrafiltration Rates

J. HEMODIALYSIS DELIVERY SYSTEMS
- 1. Purpose
- 2. Dialysate Delivery System
  - a. Proportioning System
  - b. Monitoring System

K. MEASURING DIALYSIS ADEQUACY
- 1. Urea Reduction Ratio
- 2. Urea Kinetic Modeling (UKM)
- 3. Other Methods of Determining Kt/V: The Natural Log Formula
- 4. NKF-DOQI Guidelines

L. FACTORS AFFECTING DIALYSIS TREATMENT
- 1. Clearance Factors
- 2. Time Factors
- 3. Patient Well-being
- 4. Other

M. QUALITY IN DIALYSIS
- 1. Reasons for Measuring Dialysis Quality
- 2. Quality Assurance Standards for Dialysis
- 3. Guidelines for Dialysis Care
  - a. RPA Guideline for Hemodialysis Adequacy
  - b. NKF-DOQI Guidelines
- 4. Continuous Quality Improvement
  - a. CQI
  - b. Quality Tools (PDCA Cycle)

N. VASCULAR ACCESS
- 1. Types of Access
  - a. Arteriovenous (AV) Fistula
  - b. Grafts
  - c. Catheters
  - d. Other

2. Vascular Access Procedures
    a. Venipuncture Procedures
    b. Catheter Care
    c. Other
3. Complications
    a. Clotting
    b. Aneurysms and Pseudoaneurysms
    c. Bleeding

II. CARE OF THE PATIENT WITH KIDNEY FAILURE

A. RENAL ANATOMY AND PHYSIOLOGY
1. How Healthy Kidneys Work
2. Structure of the Kidneys
    a. Nephrons
    b. Glomerulus
    c. Tubule
    d. Excretory Functions
    e. Endocrine

B. RENAL FAILURE
1. Acute Renal Failure
2. Chronic Renal Failure
3. Causes of Chronic Renal Failure
    a. Diabetes
    b. Renal Osteodystrophy
    c. Glomerulonephritis
    d. Cystic Disorders or Polycystic Kidneys
    e. Drug Toxicity
    f. Interstitial Nephritis
    g. Obstruction
    h. Other causes
4. Complications of Uremia
    a. Anemia
    b. Renal Osteodystrophy
    c. Pericarditis
    d. Electrolyte Imbalances
    e. Nerve Damage (Neuropathy)
    f. Carpal Tunnel Syndrome
    g. Itching
    h. Sleeping Problems
    i. Bleeding Abnormalities
    j. Reproductive System Changes
    k. Renal Disease with Other Illnesses

C. TREATING RENAL FAILURE
1. Choosing a Treatment Modality
2. Transplantation
3. Peritoneal Dialysis
    a. CAPD
    b. CCPD

4. Hemodialysis
    a. Fluid Compartments
    b. Treatments
    c. In-center
    d. Home
    e. Nocturnal Home Dialysis
5. No Renal Replacement Therapy

D. NUTRITIONAL CONSIDERATIONS
1. Role of the Renal Dietitian
    a. Assessment of Dietary Intake
    b. Anthropometric Measurement
    c. Biochemical Evaluation
    d. Medical History Record
    e. Subjective Global Assessment (SGA)
    f. Diet Planning
2. Renal Diet Considerations
    a. Protein
    b. Calories
    c. Fluid
    d. Sodium
    e. Potassium
    f. Calcium
    g. Phosphorus
    h. Vitamins

E. HELPING PATIENTS ADJUST
1. The Role of the Nephrology Social Worker
2. Renal Rehabilitation
    a. Encouragement
    b. Education
    c. Exercise
    d. Employment
    e. Evaluation
3. Associations with Patient Services
    a. The American Association of Kidney Patients (AAKP)
    b. The American Diabetes Association (ADA)
    c. The American Kidney Fund (AKF)
    d. The ESRD Forum of Networks
    e. The Life Options Rehabilitation Resource Center (RRC)
    f. The National Kidney Foundation (NKF)

F. COMMUNICATION SKILLS
1. Patient Confidentiality – HIPAA
    a. Paper Records
    b. Electronic Records
2. Active Listening
3. Boundaries

4. Patient Education
    a. Readiness
    b. Need
    c. Appropriate Level
    d. Reinforcement
    e. Belief

III. DIALYSIS PROCEDURES AND DOCUMENTATION

A. PREDIALYSIS PROCEDURES
1. Following Hemodialysis Orders and Treatment Plan
2. Equipment Preparation Procedures
    a. Preparing Dialysate
    b. Assembling the Extracorporeal Circuit
    c. Priming the Dialyzer and Extracorporeal Circuit
    d. Preinitiation Check
3. Predialysis Patient Check Procedures
    a. Weight
    b. Bood pressure
    c. Pulse
    d. Respiration
    e. Temperature
    f. Communicating with Patient
    g. Evaluating Vascular Access

B. INITIATION OF DIALYSIS
1. Fluid Removal Procedures
    a. Calculating Amount of Fluid to be Removed
    b. Predicting Ultrafiltration
    c. Calculating Transmembrane Pressure (TMP)
    d. Calculating Ultrafiltration Rate
    e. Fluid Replacement
    f. Isolated Ultrafiltration
2. Other

C. MONITORING DURING DIALYSIS
1. Patient Monitoring Procedures
    a. Taking Vital Signs
    b. Monitoring General Patient Condition
    c. Providing Comfort and Diversion During Dialysis
2. Technical Monitoring
    a. Monitoring Devices
    b. Equipment Safety Checks
    c. Extracorporeal Circuit Monitors

D. POSTDIALYSIS PROCEDURES
1. Completing Dialysis Treatment Procedures
    a. Discontinuing Dialysis
    b. Postdialysis Patient Check
    c. Taking Vitals Signs and Weight
    d. Documentation
    e. Equipment Clean-up

E. MEDICATIONS, SOLUTIONS, AND LABORATORY TESTS
1. Medications Commonly Used in Dialysis
a. Heparinization During Dialysis
b. Other
2. Medications and Solution Procedures
a. Drawing Solutions
b. Using IV Solutions
3. Laboratory Test Procedures
a. Drawing Blood Specimens
b. Blood Sampling Pre and Postdialysis, BUN Measurements
c. Monitoring for Anemia
d. Determining Random Blood Sugars (Glucose)
F. DOCUMENTING PATIENT CARE
1. Treatment Record

IV. COMPLICATIONS DURING DIALYSIS

A. MEDICAL COMPLICATIONS
1. Air Embolism
2. Anaphylaxis
3. Angina
4. Arrythmias/Disrythmias
5. Cardiac Arrest
6. Dialysis Disequilibrium Syndrome
7. Fever and/or Chills
8. First-use Syndrome
9. Headache
10. Heparin Overdose
11. Hyperkalemia
12. Hypertension
13. Hypotension
14. Muscle Cramps
15. Nausea and Vomiting
16. Pruritis
17. Seizures
B. TECHNICAL COMPLICATIONS
1. Air in Bloodlines
2. Blood Loss
3. Clotting in the Extracorporeal Circuit
4. Crenation
5. Dialyzer Membrane Leak
6. Hemolysis
7. Power Failure

V. WATER TREATMENT AND DIALYSATE PREPARATION

- A. PURPOSE OF WATER TREATMENT
  - 1. Preventing Harm to the Patient
  - 2. Preventing Damage to Equipment
- B. TYPES OF CONTAMINANTS AND THEIR EFFECTS ON PATIENTS
  - 1. How Water Becomes Impure
  - 2. Microorganisms
    - a. Bacteria
    - b. Viruses
    - c. Algae
    - d. Fungus
    - e. Mold
    - f. Endotoxin
    - g. Biofilm
  - 3. Organic and Chlorine-based Contaminants
    - a. Chlorine and Chloramines
    - b. Pesticides and Herbicides
  - 4. Inorganic Contaminants
    - a. Sediments, Particles, and Silt
    - b. Salts and Other Chemicals
    - c. Metals and Heavy Metals
    - d. Radionuclides
- C. COMPONENTS OF A WATER TREATMENT SYSTEM
  - 1. Filters
    - a. Sediment/Bed Filters
    - b. Membrane Filters
    - c. Ultrafilters
  - 2. Carbon Tanks
  - 3. Water Softener
  - 4. Reverse Osmosis (RO) Equipment
    - a. Cellulose Acetate Membranes
    - b. Aromatic Polyamide Membranes
    - c. Thin Film Composite (TFC) Membranes
    - d. Other Membrane Factors
  - 5. Deionizer
  - 6. Ultraviolet Light
- D. MONITORING A WATER TREATMENT SYSTEM
  - 1. Continuous Monitoring
    - a. Temperature
    - b. Pressure
    - c. Flow Rates
    - d. Conductivity and Resistivity
    - e. Total Dissolved Solids (TDS)
  - 2. Periodic Monitoring
    - a. Softener Timer Settings
    - b. Hardness Testing
    - c. Total Chlorine and and Chloramines
    - d. Chemical Analysis
    - e. pH

f. Others
3. Microbiological Testing
a. ANSI/AAMI RD52 Dialysate for Hemodialysis
b. Other
4. Disinfection Strategies
a. Standard Disinfection
b. High-Level Disinfection
E. DIALYSATE AND CONCENTRATE PREPARATION
1. Dialysate
a. Purpose
b. Types
c. Water Requirements
d. Monitoring
2. Chemical Composition
a. Sodium (Na^+)
b. Potassium (K^+)
c. Magnesium (Mg^{++})
d. Calcium (Ca^{++})
e. Chloride (Cl^-)
f. Glucose
g. Bicarbonate (HCO_3^-)
3. Concentrates
a. Acid Concentrate Preparation
b. Bicarbonate Concentrate Preparation
4. Verification and Monitoring
a. Conductivity Meters
b. Priming Procedures
c. pH Testing
d. Hydrometer - Specific Gravity Testing
e. Microbiological Testing
5. Documentation
a. Recordkeeping
b. Batch Records
6. Disinfection and Cleaning Strategies
a. Regular Disinfection
b. High-Level Disinfection
c. Precipitate Cleaning

VI. INFECTION CONTROL AND SAFETY

A. CDC RECOMMENDATIONS FOR PREVENTING TRANSMISSION AMONG CHRONIC HEMODIALYSIS PATIENTS
1. Proper Infection Control
a. Maintaining Asepsis
b. Microorganisms With Proper Hand Washing and Glove Removal
c. Dialysis Precautions
2. Preventing the Spread of Bloodborne Disease and Antibiotic-Resistant Bacteria
a. Hepatitis B
b. Hepatitis C (HCV)
c. Human Immunodeficiency Virus (HIV)
d. Methicillin-resistant Staphylococcus Aureas (MRSA)

e. Vancomycin-resistant Enterococcus (VRE)
f. Disposing of Infectious Wastes

3. Preventing the Spread of Airborne Infection
a. Tuberculosis (TB)

B. OSHA BLOODBORNE PATHOGENS STANDARD
1. Written Plan
2. Personal Protective Equipment
3. Appropriate Housekeeping Procedures – Proper Infectious Waste Disposal
4. Appropriate Laundry Handling
5. Training Program
6. Medical Records – Related to Hepatitis B (HBV) Vaccination/ Exposure to HIV or HBV
7. Training Records
8. Surveillance Strategies
9. Engineering Controls – i.e. Clean vs. Dirty Sinks
10. BBP Spill Kit

C. OSHA NEEDLESTICK PREVENTION ACT
1. Written Plan
a. Engineering Controls – Safety Needles, One-handed Technique, Sharps Containers
b. Training
c. Recordkeeping

D. OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) REGULATIONS
1. Hazard Communications Standard
2. Occupational Exposure to
a. Acetic Acid
b. Hydrogen Peroxide
c. Glutaraldehyde
d. Bleach
e. Ozone
3. Ergonomics
4. Body Mechanics
5. Patient Transfer

E. NATIONAL FIRE PROTECTION AGENCY 101: LIFE SAFETY CODE

F. DISASTER PLANNING FEMA, OSHA, NFPA, CMS, STATE

VII. DIALYZER REPROCESSING

A. HISTORY OF DIALYZER REPROCESSING

B. BENEFITS AND RISKS OF REPROCESSING

C. SET-UP AND RECIRCULATION OF A REPROCESSED DIALYZER
1. Presence Testing
2. Reuse Label
3. Priming the Extracorporeal Circuit
4. Recirculation Time
5. Residual Testing

D. POST-TREATMENT HANDLING OF REPROCESSED DIALYZERS
1. Handling Used Dialyzers
2. RUF

E. OTHER RELATED SUBJECTS
1. Clearance
2. Total Cell Volume

3. Chemical Permissible Exposure Limits (PEL)
    a. Acetic Acid
    b. Hydrogen Peroxide
4. Fiber Bundle Integrity Testing (Pressure Holding)
5. AAMI Requirements for Testing
    a. TBV
    b. Microbial and Endotoxin Testing RD47
    c. Pressure Testing
    d. Dialyzer Identification

CONTENT OUTLINE FOR BIOMEDICAL NEPHROLOGY TECHNOLOGY

THE CERTIFICATION EXAMINATION IN BIOMEDICAL NEPHROLOGY TECHNOLOGY WILL BE WEIGHTED IN APPROXIMATELY THE FOLLOWING MANNER:

I.	Principles of Dialysis	25%
II.	Scientific Concepts	10%
III	Electronic Applications	10%
IV	Water Treatment	20%
V.	Equipment Functions	13%
VI.	Environmental/Regulatory Issues	12%
VII.	Dialyzer Reuse/Reprocessing	10%

I. PRINCIPLES OF DIALYSIS

A. HAZARD COMMUNICATION AND SAFETY
1. Prevention of Occupational Injuries
2. Hazard Prevention and Control
3. Power Failure/Manual Dialysis
4. Water Failure: Main Water Valve
5. Disaster Procedure/Evacuation Kit
6. Employee-related Incidents
7. Chemical Emergencies/Hazardous Communication/Spill Kit
8. Life Cycle of Bacteria
9. Patient-related Incidents
10. Risks and Hazards of Peracetic Acid Solution (Renalin)
11. Chemical Agents
    a. Uses
    b. Effects
    c. Potential Hazards

B. DIALYSIS CLINIC
1. Professionalism of Role
2. Health Care Professionals
3. Team Participation
4. Single Patient Machine versus Central Delivery System
5. Relationships of Professional Duties

C. WATER
1. Effects of Constituents in Water
2. Rinsing of Dialysis and Equipment
3. Predialysis Water Testing Requirements
4. Suspected Pyrogens and Bacteria
5. Purpose of Water Treatment
6. Chlorine/Chloramine Awareness

D. DIALYSIS PATIENT
1. Monitoring Patient During Treatment
2. Artificial versus Normal Kidneys
3. Blood Chemistry versus Dialysate Chemistry
4. Routine Tests
5. Preparation of Concentrate
6. Acute and Chronic Renal Failure
7. Pathophysiology of Kidney and Urinary System
8. Diet
9. Hypokalemia/Hyperkalemia
10. Pulmonary Edema
11. Patient Rights

E. STANDARD PRECAUTIONS
1. Practicing Safe Habits
2. Disposal of Supplies
3. Infection Control Policies and Procedures
4. Routes of Transmission of Biological and Chemical Agents
5. Bloodborne Pathogens
6. Hazards of Biological Effects

F. DIALYSIS PROCESS
1. Adjunctive Therapy
2. Treatment Modalities for ESRD Patients
3. Heparinization
4. Fluid, Electrolyte, Acid-base Balance, Composition
5. Dialyzers
6. Charting
7. Adequacy
8. Laboratory Values
9. Bone Disease
10. Dialysis
    a. Solute Transfer During Dialysis
    b. Principles
    c. Procedures
11. Transport Mechanisms Through Semipermeable Membranes
12. Blood Access
13. Ultrafiltration and TMP
14. Dialysis Machines
    a. Functional Parts
    b. Monitoring Parts
    c. Acceptable Machine Parameters

15. Kinetic Modeling/Urea Reduction Ratio
16. Medications

II. SCIENTIFIC CONCEPTS

A. Chemistry
1. Dialysate
a. Functions
b. Chemical Composition
c. Types
d. Water Requirements
e. Dialysate Verification
f. Monitoring
2. Dialysate Composition
a. Augmentation of Concentrates
b. Monitoring of Electrolytes
c. Methods for Verifying Composition
3. Concepts

B. Physics
1. Fluid Dynamics
a. Pressure, Flowrate, and Restriction
b. Diffusion
2. Thermodynamics
3. Centigrade (Celsius)/Fahrenheit/Rankan/Kelvin

C. Mathematics
1. Statistics
a. Mean
b. Median
2. Metric versus English System
3. Calculations
4. Scientific Notation

III. ELECTRONIC APPLICATIONS

A. Electronics
1. Components of Electrical Equipment
2. Relationships – Voltage, Amperage, Resistance
3. Basic Multimeter Skills
4. Concepts
a. Transformers
b. Relays
5. Reading Wiring Diagrams/Schematics
6. Electrical Safety
7. Handling of PC Boards
8. Soldering Skills

B. Computers
1. Cabling
2. Operating Systems
3. Computer Components

IV. WATER TREATMENT

- A. Water Treating Systems
  - 1. Disinfection and Rinsing Procedures
  - 2. Testing Procedures
  - 3. Facility Needs
  - 4. System Monitoring
- B. pH Theory
- C. Bleach, Renalin, Formaldehyde
- D. Reverse Osmosis
- E. Analysis of Source Water
- F. Filtration Methods
- G. Plumbing Requirements
- H. System Design/Removal of Abnormal Water Constituents
- I. Deionization
- J. Water Cultures
- K. Chloramine Checks
- L. Start-up
- M. Monitoring and Logging
- N. Record Keeping Practices
- O. Bacteriology Monitoring, Microbiology Cultures
- P. Softening
- Q. Constituents in Water
- R. Laminar Flow versus Turbulent Flow
- S. Suspected Pyrogens
- T. Ultraviolet Treatment
- U. Culture Record
- V. Water Sample Collection
- W. Carbon Service/Automated

V. EQUIPMENT FUNCTIONS

- A. Machine Functions
  - 1. Modular Operational Aspects
  - 2. Machine Disinfecting Procedures
  - 3. Single Patient versus Central Delivery
  - 4. Machine Functions
    - a. Patient Safety
    - b. Other Functions
  - 5. Dialysis Fluid Delivery Systems
  - 6. AAMI Standards for Dialysate Supply Systems
  - 7. Ancillary Equipment
  - 8. Conductivity
  - 9. Machine Safety
  - 10. Rinsing Procedures
  - 11. Machine Disinfection
  - 12. Dialysis Machine Alarm Values and Testing Procedures
  - 13. Machine Parameters
  - 14. Altering Composition of Dialyzing Fluid
  - 15. pH
  - 16. Operating Parameters of Equipment

17. Concentrate Storage/Delivery
18 Machine Component Relationships
19. Machine Internal Component Identification and Function
20. AAMI Electrical Leakage Testing

B. Maintenance and Repair of Equipment
1. Manufacturer's Guidelines
a. Technical Assistance
b. Preventive Maintenance/Repair
c. Use of Equipment
2. Service Logs
3. Water Treatment Equipment
4. Vinegar
5. Repair Maintenance Records
6. Abnormal Machine Functions
7. Equipment Manuals
8. Evaluation of Dialysis Equipment & Supplies
9. Tool Identification
10. Plumbing Fittings, Sizes, Material

VI. ENVIRONMENTAL/REGULATORY ISSUES

A. Plant Layout and Inventory Control
1. Receiving Supplies
2. Stock Room Orientation
3. Disposal of Boxes
4. Maintaining Stock
5. Supply/Inventory
6. Checking Availability of Supplies
7. Physical Plant Maintenance Resources
8. Unit Design

B. Standards
1. AAMI Standards
a. Concentrate
b. Hemodialysis Systems
c. Disinfection
d. Parameters of Safe Product Water
2. ADA Requirements
3. CDC Specifications/Guidelines
4. Water Quality Requirements
a. Bacteriology
b. Heavy Metal
c. Reduction from City to Treated Quality
5. OSHA Regulations
6. HIPAA

VII. DIALYZER REUSE/REPROCESSING

A. Dialyzer Dynamics
1. Clearance, KoA, Dialysis Pressures, Backfiltration
2. Concentrate Storage/Delivery
3. Clinical Layout

4. Determining Adequate Dialysis
5. Hemodialyzers
6. KUF on Transmembrane Pressure and Ultrafiltration Rate

B. Reprocesssing

1. Reused Dialyzer
    a. Testing Procedures
    b. Positive and Negative Aspects
    c. Contraindicated Conditions
    d. Autorinse
2. Automated Reprocessing Equipment
3. Manual Reuse
4. Improper Reuse
5. Patient Consequences
6. Record Keeping Practices
7. Flow Sheet Requirements
8. Dialyzer Reprocessing
9. Priming Procedures
10. Sterilization/Disinfection/Cleaning of Dialyzer
11. Program Monitoring
12. Consent Form
13. Procedure
14. Master Manual Compilation
15. Prerinsing/Prefilling
16. Efficiency of Dialyzer
17. Storage
18. Safety Precautions
19. Bacteriology
20. Related Incident Reports
21. Chemical Agents

SAMPLE EXAMINATION QUESTIONS

In the following questions, choose the one best answer.

1. Which of the following counteracts the effects of heparin?

    1. Vitamin K
    2. Coumadin
    3. Aspirin
    4. Protamine sulfate

2. The surface area of a dialyzer is measured by which of the following increments?

    1. Angstroms
    2. Cubic meters
    3. Square meters
    4. Cubic millimeters

3. With reference to current in a typical circuit path, the switching voltage in components is generally referred to as

    1. ac and dc.
    2. high and low.
    3. analog and digital.
    4. positive and negative.

4. Which of the following is NOT a function of the nephron?

    1. Filtration
    2. Metabolism
    3. Secretion
    4. Reabsorption

5. Which of the following veins is used most often for routine venipuncture?

    1. Radial vein
    2. Basilic vein
    3. Cephalic vein
    4. Dorsal venous network

ANSWERS TO SAMPLE QUESTIONS:

1. 4 2.3 3.4 4. 2 5. 1

REFERENCES

The National Nephrology Certification Organization has prepared a suggested reference list to assist in preparing for the Certification Examinations in Clinical Nephrology Technology and Biomedical Nephrology Technology. These references contain journals and textbooks which include information of significance to nephrology technology. This list does not attempt to include all acceptable references nor is it suggested that the Nephrology Certification Examinations are necessarily based on these references.

Amgen Technician Core Curriculum 4th Ed.

ANSI/AAMI RD47, 52, 62

CDC 50(RR05); 1-43 Recommendations for Preventing Transmission Among Chronic Hemodialysis Patients, 2001, OSHA BBP Standard.

CMS

HIPAA Act of 1996.

Gibilsco, S. (2005). Electronics Demystified. NY: NY: McGraw Hill.

Gutch, C.F, Stoner, M.H., and Corea, A.L. Review of Hemodialysis for Nurses and Dialysis Personnel, 6th edition. Mosby.

Hazard Communication Standard

Morelli, C. (1996). Basic Principles of Water Treatment. Littleton, CO: Tall Oaks Publishing, Inc.

NANT Reprocessing Core Curriculum.

NFPA Life Safety Code

OSHA CFR (various)

Osmonics (1996). Pure Water Handbook, 2nd ed. Minnetonka, MN.

Ward, Luehmann, et al, 1992, FDA A Manual on Water Treatment for Hemodialysis.

Application for Certification Examinations in
Nephrology Technology - Part I

MARKING INSTRUCTIONS: This form will be scanned by computer, so please make your marks heavy and dark, filling the circles completely. Please print uppercase letters and avoid contact with the edge of the box. See example provided. →

A B C D E F 1 2 3 4 5 6

Candidate Information

Please enter your Name exactly as it appears on your current Government-Issued Photo I.D.

◯ Mr.
◯ Mrs.
◯ Ms.
◯ Dr.

Last Name

Middle Initial

First Name

Suffix (Jr., Sr. , etc.)

Home Address - Number and Street

Apartment Number

City

State/Province

Zip/Postal Code

Daytime Phone - -

Evening Phone - -

Email Address (Please enter only ONE email address. Use two lines if your email address does not fit in one line.)

Eligibility and Background Information

Darken only one choice for each question unless otherwise directed.

A. EXAMINATION FOR WHICH YOU ARE APPLYING:

◯ Clinical Nephrology Technology
◯ Biomedical Nephrology Technology
◯ Dialysis Water Specialists

B. ARE YOU CURRENTLY OR WERE YOU EVER CERTIFIED IN ANY OF THESE SPECIALTY AREAS BY THE NNCO?

◯ No ◯ Yes ***(Select certificate below)***

☐ CCNT - Certified Clinical Nephrology Technology

CURRENT CCNT CERTIFICATE #

CCNT MONTH/YEAR CERTIFICATION LAPSES: _____/_____ (MM/YYYY)

☐ CBNT - Certified Biomedical Nephrology Technology

CURRENT CBNT CERTIFICATE #

CBNT MONTH/YEAR CERTIFICATION LAPSES: _____/_____ (MM/YYYY)

☐ CDWS - Certified Dialysis Water Specialists

CURRENT CDWS CERTIFICATE #

CDWS MONTH/YEAR CERTIFICATION LAPSES: _____/_____ (MM/YYYY)

C. HAVE YOU TAKEN THIS EXAMINATION BEFORE?

◯ No ◯ Yes

If yes, indicate month, year, and name under which the examination was taken.

Date (month/year): _____

Name: _____

D. EXPERIENCE IN THE FIELD OF NEPHROLOGY:

◯ Less than 1 year
◯ 1 year (or 2000 hours part-time)
◯ 2 to 4 years
◯ 5 to 10 years
◯ More than 10 years

E. CURRENT PRIMARY POSITION: (Darken one response.)

◯ Patient Care Technician
◯ Equipment Technician
◯ Chief Technician
◯ Reuse Technician
◯ Administrator
◯ Student
◯ Field Service Technician
◯ Other (specify): _____

F. PRIMARY FORM OF DIALYSIS IN WHICH YOU ARE INVOLVED: (Darken only one response.)

◯ Chronic Hemodialysis ◯ PD ◯ In-Patient Hemodialysis
◯ Home Hemodialysis ◯ Other (specify): _____

G. PRIMARY AREAS OF DIALYSIS IN WHICH YOU ARE INVOLVED:

◯ Patient Care
◯ Administration
◯ Equipment Maintenance
◯ Transplant
◯ Water Treatment
◯ Reuse
◯ Other (specify below): _____

H. PERCENT OF WORKING TIME YOU CURRENTLY SPEND IN NEPHROLOGY TECHNOLOGY:

◯ Less than 25%
◯ 25 to 50%
◯ 51 to 75%
◯ Over 75%

I. EMPLOYMENT SETTING:

◯ Community Hospital
◯ University Medical Center
◯ Free Standing Unit
◯ Manufacturer/Supplier
◯ Other (specify below) _____

(Continue on page 2)

NNCO, PROFESSIONAL TESTING CORPORATION, 1350 BROADWAY, 17th FLOOR, NEW YORK, NY 10018
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NATIONAL NEPHROLOGY NNCO CERTIFICATION ORGANIZATION

Application for Certification Examinations in

Nephrology Technology - Part I

Eligibility and Background Information

J. HIGHEST ACADEMIC LEVEL:

- ◯ High School Diploma or Equivalent
- ◯ Certificate in Nephrology Technology
- ◯ Associate's Degree
- ◯ Bachelor's Degree
- ◯ Master's Degree
- ◯ Doctorate

K. ARE YOU A MEMBER OF ISNTT?*

◯ No ◯ Yes

L. ARE YOU A MEMBER OF NANT?*

◯ No
◯ Yes: Membership # _____

M. ARE YOU A MEMBER OF AAMI?*

◯ No
◯ Yes: Membership # _____

N. ARE YOU A MEMBER OF ANNA?*

◯ No
◯ Yes: Membership # _____

Note: Membership is not required.

O. ARE YOU AN LPN/LVN?

◯ No ◯ Yes

P. ARE YOU AN RN?

◯ No ◯ Yes

Clinical Nephrology Technician Candidates in Ohio Only

PLEASE NOTE: Clinical Nephrology Technician Candidates in Ohio are required to have at least 12 months of experience in dialysis care. Dialysis care is defined as: performing and monitoring dialysis procedures, including initiating, monitoring, and discontinuing dialysis; drawing blood; administering medications when the administration is essential to the dialysis process; and responding to complications that arise during dialysis.

YEARS OF EXPERIENCE IN DIALYSIS CARE:

◯ 1 year ◯ 2 to 3 years ◯ 4 to 5 years ◯ More than 5 years

Optional Information

Note: Information related to race, age, and gender is optional and is requested only to assist in complying with general guidelines pertaining to equal opportunity. Such data will be used only in statistical summaries and in no way will affect your certification.

Race:

◯ African American ◯ Native American ◯ Other
◯ Asian ◯ White
◯ Hispanic ◯ No Response

Age Range:

◯ Under 25 ◯ 40 to 49
◯ 25 to 29 ◯ 50 to 59
◯ 30 to 39 ◯ 60+

Gender:

◯ Male
◯ Female

Candidate Signature

I have read the Handbook for Candidates and understand I am responsible for knowing its contents. I certify that the information given in this Application is in accordance with Handbook instructions and is accurate, correct, and complete. I am aware that my application is valid for six (6) months. If I do not sit for the exam within six months, I will need to reapply for the examination and pay a new fee.

CANDIDATE SIGNATURE: _____ ***DATE:*** _____

CREDIT CARD PAYMENT *If you want to charge your application fee on your credit card provide all of the following information.*

Name (as it appears on your card): _____

Address (as it appears on your statement): _____

Charge my credit card for the total fee of: $ ____

Expiration date ____ / ____

Card type: ◯ Visa ◯ MasterCard ◯ American Express

Card Number: ____

SIGNATURE: _____

FOR OFFICE USE ONLY

Date

Fee: ____

☐ CC ☐ Check

14239

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APPLICATION FOR CERTIFICATION EXAMINATIONS IN NEPHROLOGY TECHNOLOGY - PART II

NAME: (please print) _____ **Date of Birth:** _____/_____/_____
Last Name First Name Middle Initial

HAVE YOU EVER BEEN KNOWN BY ANY OTHER NAME? (including maiden name) _____ No _____ Yes Other name(s): _____

Name for Certificate: _____ **Social Security Number:** _____

WORK ADDRESS: _____ **TELEPHONE NUMBER:** (_____)_____
Street City State ZIP Code

HOME ADDRESS: _____ **TELEPHONE NUMBER:** (_____)_____
Street City State ZIP Code

EXAMINATION FOR WHICH YOU ARE APPLYING: _____**Clinical Nephrology Technology** _____**Biomedical Nephrology Technology** _____**Dialysis Water**

EDUCATIONAL HISTORY: List each school, nephrology technology program, college, or university attended. Use separate sheet if necessary.

Institution: _____ Address: _____
City State
Year of Graduation: _____ Degree/Diploma/Certificate earned: _____

Institution: _____ Address: _____
City State
Year of Graduation: _____ Degree/Diploma/Certificate earned: _____

Institution: _____ Address: _____
City State
Year of Graduation: _____ Degree/Diploma/Certificate earned: _____

EMPLOYMENT HISTORY: List most recent first. Use separate sheet if necessary.

Date of Employment: From _____ To _____ Employer: _____ Position Title:_____
Address: _____ Supervisor: _____ Hours/week: _____

Date of Employment: From _____ To _____ Employer: _____ Position Title:_____
Address: _____ Supervisor: _____ Hours/week: _____

Date of Employment: From _____ To _____ Employer: _____ Position Title:_____
Address: _____ Supervisor: _____ Hours/week: _____

PROFESSIONAL AFFILIATIONS: _____

CANDIDATE AFFIRMATION: **I understand the National Nephrology Certification Organization reserves the right to verify any or all information on this application and that certification depends upon successful completion of the specified eligibility requirements and examination. To the best of my knowledge, the information contained in this application is true, complete, correct, and is made in good faith.**

➡

_____
Signature of Candidate Date